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Immersive Storytelling in 360-Degree Videos: An Analysis of Interplay Between Narrative and Technical Immersion

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Abstract

Three-hundred-and-sixty-degree videos are an innovative video format, and due to various narrative and technical aspects, they allow audiences to be deeply immersed in their content. Through an explorative, qualitative content analysis (and parts of narrative analysis) aspects of immersion were explored in various 360-degree videos. Our results give an overview of multiple immersive factors in 360-degree storytelling and the interplay of narrative and technical aspects of immersion. Technical immersion manifests through cues to direct the viewer's attention and cues to acknowledge the viewer as a part of the virtual environment. Narrative immersion, on the other hand, is influenced by the setting, as well as by the interplay of story, characters, and viewer integration. Our findings also indicate that narrative and technical aspects support each other to strengthen immersion.

1. Introduction

Three-hundred-and-sixty-degree videos are a new viewing experience, allowing audiences to become deeply immersed in their content. The viewers can turn in any direction while a fixed, linear story unfolds around them. The events take place from the perspective and position of the camera (Sheikh et al., 2016, p. 1), which is similar to traditional, linear video formats like TV shows or movies. Nevertheless, the viewers are in control of their own gaze. The field of view (FOV) can be changed by the movement of the head or device (Conroy, 2017). So, they can be characterized as a lean-in medium (Vosmeer & Schouten, 2014, p. 146) that turns the viewer into an active observer (compared to traditional video), or a passive participant compared to virtual reality (VR). Unlike VR, the viewer cannot walk around in the virtual environment (VE) nor can they modify objects and characters within it.

Several studies suggest 360-degree videos are highly immersive (Argyriou et al., 2016; Fonseca & Kraus, 2016). To date, most research consists of quantitative experiments that concentrate on audience perception of content (e.g., Sheikh et al., 2016), or viewing habits (e.g., Tang & Fakourfar, 2017). There are also some technologically focused studies, e.g., on watching a video with different devices (Fonseca & Kraus, 2016, p. 1). In this research, we use a qualitative content analysis that explores various forms of narrative and technical immersion in 360-videos. Additionally, we compare them to traditional video formats (which have a set frame and angle) and to more interactive formats such as VR.

2. Theoretical Framework

Storytelling presents itself in many forms. However, it is almost always a method of presenting information through a coherent story. Narratives have a clear and identifiable structure, as well as agents that determine the story (e.g., Hinyard & Kreuter, 2007, p. 778). Comparative analyses of traditional and digital storytelling (e.g., Bordwell, 2008; Dowd et al., 2013; Miller, 2013) show the prominence and persuasive potential of narratives (e.g., Green & Brock, 2000). This research is focused on narrative and technical stimuli that may potentially induce immersion: a psychological state of an individual who feels absorbed into a VE induced by specific stimuli (Witmer & Singer, 1998, p. 227). Former research on body centered interaction (Slater & Usoh, 1994; Slater et al., 1996) and on narrative transportation (Phillips & McQuarrie, 2010) can illustrate two main dimensions of immersion: narrative and technical. While there are, of course, other basic types of immersion like social immersion, we use these two distinctions as an initial point for the case study because these two seem the most appropriate for the 360-degree video format. Specific aesthetic characteristics are conceived as beneficial for immersion, or the subjective feeling of being present (presence) in a virtual environment (Steuer, 1992; Witmer & Singer, 1998; Ijsselstein et al., 2000; Ijsselstein & Riva, 2003) but there are also technical factors that may disturb the illusion of being part of the story world. Although there is some preliminary research regarding storytelling in 360-degree videos (e.g., Bleumers et al., 2012; Argyriou et al., 2016; Kavanagh et al., 2016; Sheikh et al., 2016;), none of these studies compares it to other video formats. Unlike these studies, we conclude by relating our results to studies on storytelling in traditional formats, as well as newer formats such as VR.

2.1. Technical Immersion

We base our analysis of technical immersion on a previous study by Sheikh et al. (2016), which provides a thorough list of characteristics. For instance, the acknowledgement of the viewer by characters can be pinpointed through looks, gestures, and words the actors direct towards the camera (e.g., Sheikh et al., 2016, pp. 1-7). The representation of the viewer, as a visible and virtual body, can enhance the feeling of being present in the story world (Slater & Usoh, 1994, p. 18). The

potential of 360-degree videos is not fully utilized if the viewer is not directed to look around or move to follow the main story. Hence, visual and acoustic direction cues are essential (Sheikh et al., 2016, pp. 3-7). Additionally, technical elements that might hinder immersive effects are observed (Prothero & Hoffman, 1995; Ijsselstein et al., 2000, p. 522).

2.2. Narrative Immersion

Narrative immersion focuses on the influence of a story's content and structure on the viewer. We have adapted Ryan's (2015) description of narrative immersion in VR, allowing us to compare aspects of VR and 360-degree. Ryan differentiates four dimensions of narrative immersion. The first: spatial immersion, looks at setting, place and time of the story, as well as the composition of the world (2015, pp. 86-93). Temporal immersion, on the other hand, deals with the structure of the plot (pp. 99-106), including generating suspense, the focus of the story (character, plot or place-driven), the genre itself, and the expectations linked with it. Therefore, typical structures from traditional storytelling are part of temporal immersion, like foreshadowing upcoming events, or the hero's journey (Campbell, 1949). Spatio-temporal immersion is influenced by narrative perspective and the integration of the audience within the story (Ryan, 2015, pp. 93-99). While emotional immersion deals with the feelings a story elicits in the recipient (pp. 106-114). Studies on para-social interaction (e.g., Klimmt et al., 2006) find that the distance between characters (actors) and the viewer's character (camera), or being acknowledged by characters, in 360-degree videos may increase emotional immersion (Sheikh et al., 2016, pp. 2-6).

3. Research Questions

Our overall research interest is guided by following questions: How does immersive storytelling manifest itself in 360-degree videos? And how does that compare to traditional linear video and virtual reality formats? Building on the aforementioned theoretical framework we can specify our research interest into four research questions, which help to systematize and structure our explorative analysis of 360-degree videos:

- RQ1: How does narrative immersion manifest in 360-degree videos?
- RQ2: How does technical immersion manifest in 360-degree videos?
- RQ3: How do narrative and technical immersion interplay in 360-degree videos?
- RQ4: How does immersive storytelling in 360-videos compare to traditional and VR storytelling?

4. Methodology

To analyze the immersive storytelling of 360-degree videos in comparison to other video formats, an explorative, qualitative content analysis following Mayring (2000) is utilized. This can provide an understanding of differences, limits, and benefits of this video format compared to others. The 360-degree video format, and its research, is still in an explorative phase. Hence, a qualitative approach is suggested, as it is an open process that can generate categories and hypothesis (Strauss & Corbin, 1994). Our content analysis approach features aspects from narrative analysis, which is used to analyze the structure of a story (Cohan & Shires, 1998). This procedural method is quite similar to content analysis; both keep contextual meanings in mind, use inductive and deductive categories, and search for patterns and themes (Mayring, 2000). By combining content with narrative analysis, emergent, coherent themes can be identified, interpreted, and described with examples (Schreier, 2012, pp. 137-138).

The foundation of our code system is based on Ryan's (2015) framework for narrative immersion in VR storytelling, as well as Sheikh et al.'s (2016) work on technical immersion. These

deductive codes are used to find noticeable immersive aspects of 360-videos, while inductive codes from a preliminary analysis are used to observe how immersion manifests in 360-degree videos compared to other video formats. Utilizing a tabular code system (Mayring, 2000), the videos were watched several times on a computer. An in-depth analysis of each video is conducted through writing down observations and example quotes for each category. The results are then structured to filter out certain aspects and focus on specific criteria. Additionally, the first results were revised after having watched the videos with a head-mounted display.

The sample of 360-video was obtained from YouTube, which hosts an official “VR” channel. From the playlist “Immersive Storytelling”, and using purposive sampling, 18 videos were selected (see Table 1) that have a clear narrative, featuring a story with an identifiable beginning, middle and end. In line with our explorative approach, and to reduce selection biases, the videos span many different story genres; from action, to documentaries and dramas. Some genres like narrative music videos, which have their own playlist, and advertisements were excluded. To ensure that we can code for viewer acknowledgement in the videos, only first-person and second-person point of view (POV) videos were selected.

Table 1: List of coded 360-degree videos in alphabetic order (YouTube 2017)

Video	Uploader	Date of Upload	Runtime (Minutes)
360 Video – DO NOT Push The Red Button! (Rube Goldberg Machine)	Putty Studios	05.11.2015	01:41
360 Jeff the Killer	BlackBoxTV	06.03.2017	04:32
Augmented – A 360 VR Action Experience (Ep. 1)	IGN	16.12.2016	03:32
Bear Heist! #360 VR Experience!	devinsupertramp	26.11.2016	03:41
Building a Survival Fire Survivorman (360 Video)	Science Channel	08.03.2016	11:53
Eleven Little Roosters 360: The Sex von Shaukel Boyz	Rooster Teeth	20.12.2016	03:57
EMERGENCY SURGERY!!! (ft. Brandon Rogers) (Last Moments of Relationships #35)	FBE	11.01.2017	05:01
Hunting Bigfoot (360 video)	Destination America	08.04.2017	03:19
Internet Surfer (VR video!) ft. Zach King and Corridor	SoKrispyMedia	15.02.2017	04:08
INVASION! 360 VR FULL EPISODE	Baobab Studios	21.12.2016	06:09
Kidnapped: A 360 Experience	Rooster Teeth	08.09.2016	06:04
Kristen Stewart: Great Performers 360 VR Video The New York Times	The New York Times	08.12.2016	01:37
Luigi's Mansion Meets Ghostbusters in Real Life!	devinsupertramp	01.06.2017	07:48
Mr. Robot: Virtual Reality Experience – 360	Mr. Robot	29.07.2016	13:04
TELEPORTALED – A VR Sci-Fi Comedy #360Video	PAVR	22.07.2015	04:17

Video	Uploader	Date of Upload	Runtime (Minutes)
Terrifying Masquerade Party in 3D 360!!	devinsupertramp	08.02.2017	05:40
The LEGO Batman Movie – Batmersive VR Experience	Warner Bros. Home Entertainment	24.04.2017	05:04
The Rock Presents: “Escape From Calypso Island” – A 360 VR Adventure	The Rock	31.10.2016	08:16

5. Results

5.1. RQ1: Occurrences of Narrative Immersion

Four types of narrative immersion (spatial, temporal, spatio-temporal, and emotional immersion) manifest themselves differently in our sample. Often, they are interdependent or have aspects that influence each other.

5.1.1. Spatial immersion: It is a matter of space

Spatial immersion can be considered essential for presenting a viewer with a virtual environment they can feel present in. Mostly, it is a visual aspect and shows the place and time of a story. In addition, other elements of the narrative, like characters' dialogues or actions, can be used to determine or confirm the time, place, or rules of the story world. For example, in *The LEGO Batman Movie*, the protagonist presents a virtual replica of the fictional city Gotham to the viewer and emphasises that this experience is only a simulation (Warner Bros. Home Entertainment, 2017). While detailed settings can add narrative context to the story, simplistic sceneries may also focus the viewer's attention on the story. The importance of spatial immersion for orientation is most evident in scenes without any visual setting. For example, in *Luigi's Mansion*, the room is set in darkness to disorient both the viewer and the characters within the video (devinsupertramp, 2017).

5.1.2. Temporal immersion: It is all about plot

Temporal immersion centers on the story, the plot's structure, and set expectations. Regarding story and its structure, the used techniques and narrative devices are very similar to, or adapted from the traditional video format. Often future events are indicated by setting genre expectations, foreshadowing events, or stressing character traits before they become relevant to solve a conflict.

The stories can be character or plot-driven like traditional videos. The set place becomes more critical for storytelling in the panoramic video format. Stories that are very setting-driven contain distinct, exclusive, or extraordinary surroundings. The sets usually have certain properties that comprise details to give narrative context and can change several times, such as several floors in *Terrifying Masquerade Party* (devinsupertramp, 2017) or various missions in *The LEGO Batman Movie* (Warner Bros. Home Entertainment, 2017). Often, characters explore or present a VE; hence, much of the plot revolves around exploring your surroundings. This leads to a strong link between spatial and temporal immersion. 360-degree videos contain six directions that the viewer can look in (front, left, back, right, bottom, and top). Therefore, the viewer will certainly miss something when watching the video. Rewatchability includes reasons to watch a video again, such as gaining a deeper understanding of the story or to explore the VE further. It gives the viewer the opportunity to find

hidden details and, consequently, get more narrative context. Viewers can find clues to solve riddles or tasks set by the producers, such as the task to count ghosts in Luigi's Mansion (devinsupertramp, 2017), or they can choose to follow different characters within the VE, since some videos contain several plot lines and simultaneous actions spread throughout the 360-degree view.

While the viewer cannot influence the story like in traditional video formats, some videos create the illusion of interactivity. In *Terrifying Masquerade Party*, the protagonist wants the viewer to stand still so that he can look at them (devinsupertramp, 2017). Comments on the viewer's behavior may assist in the illusion that the individual is a part of the story and has actual influence on the events that happen.

5.1.3. Spatio-Temporal Immersion: Actions speak louder than words

Spatio-temporal immersion builds on the story world and is partly determined by characters and their actions. It includes the integration of the viewer in multiple forms: as a character (like in the first-person POV in *The LEGO Batman Movie* [Warner Bros. Home Entertainment, 2017]), an object within the narrative (*Hunting Bigfoot* [Destination America, 2017]), or as a viewer, such as a second-person POV during a vlog of the producer in Luigi's Mansion (devinsupertramp, 2017). A switch between POVs serves a narrative purpose, like increasing plausibility or giving more information. In Luigi's Mansion, there are three different dimensions of reality (a vlog, a dream, and the 'reality' of the main character) that are accompanied by different POVs. The narrative perspective of the viewer can be varied and is determined by aspects of the character's behavior towards the viewer. The role of the viewer varies the intensity of relationships with other characters in the videos.

Under this sort of immersion, deictic words can be used to create a pseudo-immediacy (Ryan, 2015, pp. 97-98). For example, spatial relations are indicated by deictic expressions in *The LEGO Batman Movie* when Batman shows the city to the viewer's character and refers to their current position ("up here") or certain buildings as "below you" (Warner Bros. Home Entertainment, 2017). These deictic cues are used to emphasise the presence of the viewer's character within the story world. Through including the viewer in both the VE and other characters' narratives, spatio-temporal immersion manifests itself.

5.1.4. Emotional immersion: It is how you make me feel

The viewer's integration within the narrative, and relationship to other characters, links spatio-temporal immersion closely to emotional immersion, with the latter determined through characters, conflicts, and the video's mood (Ryan, 2015, pp. 106-114). Emotional immersion is linked to temporal immersion in that it is driven by conflicts between characters or consequences of the character's actions.

To set the mood of a scene, different elements can contribute to emotional immersion, but often they mirror aspects that define the genre of a story. Hence, genre expectations and video's tone mutually reflect each other. Tone and style can be set by narrative aspects, like a specific or detailed setting, or even rules of the story world, such as a dark forest, in which mythical creatures are supposed to live in *Hunting Bigfoot* (Destination America, 2017). Furthermore, plot structures like the hero's journey (Campbell, 1949) may set specific expectations for the path of the protagonist, such as the main character's transformation in *Escape from Calypso Island* (The Rock, 2016).

5.2. RQ2: Occurrences of Technical Immersion

To analyze the technical aspects of immersion, both beneficial and disruptive elements were coded. Initially, an aspect of emotional immersion, acknowledgement is primarily used in first- and

second-person POV videos, where actors treat the camera like a character within the narrative by using verbal and nonverbal cues. Hence, the viewer may experience the illusion of interacting or conversing with characters or objects, even though, the actions and conversations are pre-constructed and independent from where the viewer is facing.

The character or object the viewer impersonates can have reflections and shadows, as well as a reserved space within the story world, such as a place to sit in *Escape from Calypso Island* (The Rock, 2016). The lack of a virtual body leaves the appearance of the character open to the viewer's imagination. This can be beneficial to some who can imagine themselves in the allocated position. Two videos (*Terrifying Masquerade Party* and *Luigi's Mansion*) use nuanced spatial audio to orient the viewer (devinsupertramp, 2017). However, even when the difference in volume was quite minor, it adds another interactive element and makes the experience more dependent on the viewer's gaze.

Audio-visual direction cues are more commonly used to navigate the viewer throughout the video compared to visual cues. Visual cues include movement of objects or characters, gestures, alignment of objects, the gaze of characters, lighting, extreme contrast, semantic opposites, video in video, text, graphics, special effects and camera movements. Audio cues include characters talking, screams, video in video, sound effects, and music. Orientation cues may motivate the viewer to follow certain movement, look at a source of motion or sound, explore the virtual surroundings, or to be alert. Disorientation cues put the viewer literally in the dark, such as in *Luigi's Mansion* (devinsupertramp, 2017) or use unnatural camera position and montages. If several cues are combined, they can highlight detail within the panoramic view, or distract the viewer from a secondary story line in another FOV.

The use of montages is limited; objects or actors that are positioned too close to the camera, as well as narrow spaces, get distorted (Kavanagh et al., 2016, pp. 35-37). Thus, montage is not as useful in focusing attention by using cuts and various shot sizes like in linear video. An exception is a scene in *Hunting Bigfoot*, in which the characters are introduced. The camera is positioned in the middle of a car and shows the characters and their names using name tags. To vary shot sizes, characters move closer to or further away from the camera. Actors usually emphasise their movements and facial expressions by theatrically exaggerating them (Discover America, 2017). Potentially immersion disruptive elements are often avoidable, such as continuity errors in *Terrifying Masquerade Party* (devinsupertramp, 2017) or technical distortions like stitching lines, which are unique to the video format (Bleumers et al., 2012, p. 120). To cover up these, some videos use graphical distractions, such as blurred circles. Finally, while digital additions (text or graphics) may remind the viewer that the video is edited and destroy the illusion of non-mediation (Ijsselsteijn et al., 2000, p. 522), they can also briefly explain the video format and give orientation to (first-time) viewers such as in the start of *Terrifying Masquerade Party* (devinsupertramp, 2017).

5.3. RQ3: Types of Interplay between Narrative and Technical Immersion

Suspense is created through the story's structure and is closely linked to emotional immersion, due to conflicts between characters or the intense tone of a scene. Therefore, temporal immersion and technical aspects like montage can influence each other. For example, the antagonist in *Terrifying Masquerade Party* makes the viewer's character his last victim of a massacre (devinsupertramp, 2017). This suspenseful moment is supported by jump cuts and lighting effects.

Both narrative aspects (like story world, suspense, or focalization), as well as technical aspects (like a montage or visual effects), are used to set a particular tone and style for the video. Music and lighting are incorporated into videos to set the tone; for example, the video becomes visually darker as the antagonist gains power in *Escape from Calypso Island* (The Rock, 2016). Stylistic devices like animation or the position of the camera are used to create distance or intimacy between the viewer and other characters or their actions. For example, the protagonist Batman stands further away from

the viewer's character during fighting scenes and close during friendly conversations in The LEGO Batman Movie (Warner Bros. Home Entertainment, 2017).

The viewer's impression of taking on a particular role can be supported through montage, camera movements, and special effects. For example, in The LEGO Batman Movie, the camera is positioned slightly above eye-level. This suggests that the viewer's character is smaller (and younger) than the protagonist (Warner Bros. Home Entertainment, 2017). In Hunting Bigfoot, where the viewer takes on the perspective of a camera, flickering and onscreen graphics like the battery status or time stamps support the illusion of seeing the world from an object's POV (Discover America, 2017). Additionally, camera movements can visualize the viewer's character walking in the VE. This potentially leads the viewer to believe that they can actually influence the story, even though it is pre-constructed and linear. Alternatively, the story may acknowledge the viewer's virtual presence and incorporate relevant explanations in the plot (of limitations or benefits of the video format) linking to temporal immersion. Some videos incorporate an explanation of the 360-degree video format in their narrative by using introduction videos within the story, text, or comedic comments and reactions of characters.

Particularly noticeable are rewatchability (narrative immersion) and explorability (technical immersion) of a 360-degree video (see Figure 1). These functions focus on the benefits of watching a video several times, looking around (spatial explorability) and pacing slowly, which give time to explore the VE (temporal explorability). Greater spatial explorability influences the amount of rewatchability. Both these aspects are influenced by location changes, hidden details and information in the VE, as well as multiple story lines, characters within 360-degrees, and tasks for the viewer. To improve both temporal explorability and rewatchability, the focus needs to be on other factors, such as the complexity of the story.

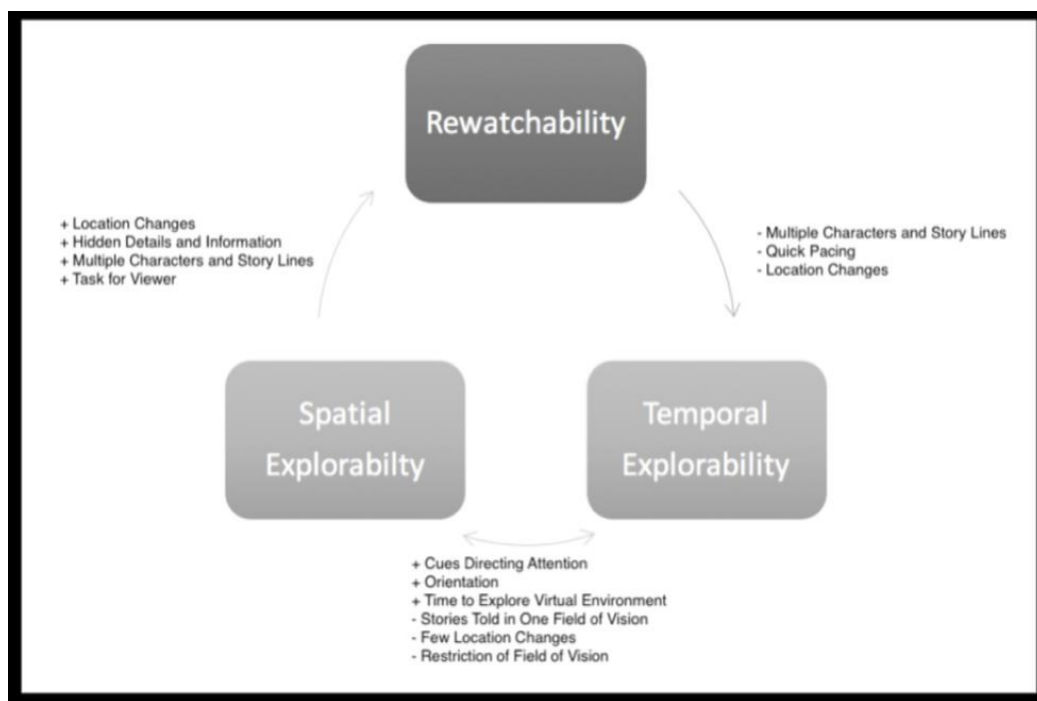


Figure 1: Relationship between rewatchability and explorability (+ = positive influence / - = negative influence)

5.4. RQ 4: Three-Sixty Story Telling Compared

Three-hundred-and-sixty-degree storytelling can be characterized as a hybrid of traditional, linear and gamified VR storytelling, with some influence from theatrical performances, such as

exaggerated movements and facial expressions. In 360-degree videos, the viewer can choose where to look within a fixed VE from the position of the camera. Hence, directing attention cues are important to inspire movements of the FOV, guiding the viewer through a story, or to make them aware of details that can give further narrative context. Additionally, spatial audio can be used to add another interactive element to the video. However, the video format is not as interactive and more restricted than VR (Conroy, 2017; Ryan, 2015, p. 2).

In 360-degree videos, similar to traditional storytelling, the viewer does not influence the plot (Vosmeer & Schouten, 2014, pp. 141-142); the interaction with characters is fixed, and the viewer has no control over anything but their gaze. However, unlike VR where player's actions form the story, the illusion of movement cannot influence the story development (Miller, 2013, p. 120). Thus, interactivity within this medium is only an illusion.

360-degree videos can be structured in acts like linear video (or theatre) and usually hold common narrative themes. Some videos have a structure similar to games by including missions. These plots turn the viewer into a passive participant or player. Narrative, game-like VR is often structured in levels that can be won or lost (Miller, 2013, p. 123). Challenges drive VR storytelling and tension derives from the obstacles a player needs to overcome or a time limit (Miller, 2013, pp. 76-77). In 360-degree videos, however, failing or succeeding in missions does not affect the outcome of the plot. Suspense is similar to traditional video (Tan, 1996, pp. 206-209), and stems from the interaction of narrative and time; presenting a mystery, disparities of knowledge, or the outcome of a continuous chain of events. For both traditional and 360-degree narratives, the plot is driven by characters, places, or actions that build up the story (Branigan, 1992, p. 118; Ryan, 2008, p. 6).

A narrator can set the perspective for linear video (Bordwell, 2008, p. 99), which can either have external or internal focalization (Branigan, 1992, pp. 101-103). This holds true for 360-degree storytelling as well. Additionally, the inclusion of the viewer as a character in the narrative can be used to determine the perspective. If there are switches of POVs, they usually serve a narrative purpose. External focalization can give the viewer more information and add plausibility to a chain of events or establish a new location, while internal focalization is often used to show the perception of the viewer. Switches in perspectives can be done using narrative sequences or special effects to simulate the perception of the viewer's character (e.g., while waking up). Atmospheric sounds can also support these switches.

Third-person shots are typically used for linear video (Branigan, 1992, p. 53). For 360-degree storytelling, first-person POV is more common, as they can incorporate the viewer as a character in the narrative which can facilitate the illusion of actually being the protagonist of a story (Miller, 2013, pp. 93-95). Within the sample, videos with a second-person POV are in the form of a vlog.

Characters can be divided into protagonists and antagonists (Dowd et al., 2013, p. 51) or main, supporting, and background characters like in traditional videos. However, to describe certain aspects like the acknowledgement of a viewer, it is also useful to consider a differentiation in non-viewer and viewer characters, like differentiating between player and non-player characters for VR and games. Conflicts stem from goals of characters, inner conflicts, or the consequences of a character's actions like in the traditional video (Thompson, 2003 p. 22; Dowd et al., 2013, p. 51), whereas in VR, conflict is presented as a challenge for the player character (Miller, 2013, p. 18).

In linear storytelling, acknowledgement is used as a stylistic device such as breaking the fourth wall or using a POV shot (Thompson & Bowen, 2013, pp. 41-43). In 360-degree videos, however, acknowledgement is a technical aspect that drives the medium; used continuously to allude to "interactivity" or drive plot development.

In (gamified) VR, the player can have a virtual representative (avatar) and may see the objects their character holds (Miller, 2013, pp. 93-95). The videos in our sample all integrated the viewer within the world. However, only a few visualized a virtual body. In such cases, the virtual body had a function within the narrative through characters' interaction. In some videos, the story is shown from the perspective of an object, like a camera, which can create authenticity. Still, most videos left virtual embodiment open for the imagination of the viewer.

A story is not necessarily told by using the full panoramic view. This holds particularly true for techniques that restrict the interactivity or control of the viewer while watching. When 360-degree videos contain scenes that are limited to a small FOV (and cut like traditional video) the viewer gains no advantage from changing the FOV or moving. These kinds of cut scenes are often used as introductions or instructions, which are triggered by specific actions (Miller, 2013, p. 80). While studies found that visual boundaries are beneficial for spatial perception (Boonsuk, 2011, p. vii), restricting one's FOV may be a disadvantage because it contradicts the main benefit of 360-degree videos. Hence, such limitations of viewer's control may be counterproductive for immersion for both VR and 360-degree storytelling.

6. Conclusion

While the effects of linear video can be described with the concepts of transportation (Green & Brock, 2000) or diegetic effect (Tan, 1996, p. 52), both VR and 360-degree videos are highly immersive and can make the viewer feel present in the VE (Witmer & Singer, 1998, pp. 225-227). As for VR (Ryan, 2015) and 360-degree videos, immersion is based on spatial aspects and includes an interplay of temporal, spatio-temporal, and emotional immersion. In addition to presenting panoramic views, this video format is able to involve the viewer in the narrative through various technical aspects. These measures, when used in combination with specific narrative elements, can incite a greater response from viewers compared to traditional video format. If utilized in the correct context, the 360-degree format can assist in engaging and connecting viewers to serious issues, from civil society to political and environmental issues.

Nevertheless, storytelling for this new, innovative format is in its beginning phase: "[T]he language of 360 storytelling is still being invented" (Warren, 2017). In the future, 360-degree storytelling may change and take on different forms, combining advanced technical aspects with pre-existing narrative approaches. Hence, the task of researching this innovative video-format is only just beginning.

7. Limitations and Future Work

The study has a few limitations. Initially, the videos researched, while belonging to different genres, were still driven by narratives. Other 360-degree videos which do not have narrative aspects may present immersion differently. Concerning coding specific phenomena, such as cues to direct attention, it is possible that the average viewer would not notice or choose to ignore them. Especially first-time watchers who may prefer to explore and test the video format. This content-analysis, however, focuses on these specific phenomena. Thus, the usefulness of cues could be overstated.

In the future, the effects 360-degree videos have on recipients could be tested using quantitative experiments. Moreover, while this analysis provides insight into the storytelling of 360-degree videos, it did not cover their full variety. Follow-up studies could concentrate on a specific genre, like music, advertising or journalistic videos.

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